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A CRITICAL EXAMINATION OF THE DEVELOPMENT OF SCIENCE CONCENTRATIONS IN THE TEACHER PREPARATION PROGRAM FOR THE PROSPECTIVE ELEMENTARY SCHOOL TEACHER AT THE UNIVERSITY OF TEXAS.

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A COMPARISON WAS MADE BETWEEN THE UNDERGRADUATES IN ELEMENTARY EDUCATION WHO HAD SELECTED EITHER BIOLOGY OR GEOLOGY AS A FIELD OF SUBJECT MATTER CONCENTRATION AND THOSE WHO HAD DECLARED SOME OTHER CONCENTRATION. THE STUDY WAS BASED ON THE PREMISE THAT PROFESSIONAL LEADERSHIP IN FUTURE SCIENCE INSTRUCTION IN ELEMENTARY SCHOOLS MUST COME FROM UNDERGRADUATES ENROLLED IN BIOLOGY AND GEOLOGY, AND WAS CONDUCTED TO FIND WAYS TO IMPROVE COUNSELING AND TO INCREASE THE NUMBER OF STUDENTS CONCENTRATING IN THOSE AREAS. SEPARATE PHASES OF THE STUDY WERE PLANNED TO (1) DETERMINE THE TRENDS IN PERCENT OF STUDENTS ENROLLED IN BIOLOGY AND GEOLOGY, (2) DETERMINE WHETHER OR NOT STUDENTS SELECTING SCIENCE DIFFERED SCHOLASTICALLY FROM OTHER STUDENTS, AND (3) IDENTIFY FACTORS THAT DETERMINED THE STUDENT'S SELECTION OF AN AREA OF CONCENTRATION. RESULTS OF THE INVESTIGATION SHOWED THAT (1) IT WAS IMPOSSIBLE TO PREDICT ACCURATELY WHAT CONCENTRATION A STUDENT WOULD SELECT FROM HIS SCHOOL AND COLLEGE APTITUDE TEST, (2) MANY STUDENTS IN THE FIELD OF ELEMENTARY EDUCATION, WHO HAD PREFERRED BIOLOGY AT HIGH SCHOOL GRADUATION, SWITCHED CHOICES WHILE IN COLLEGE, (3) SOME STUDENTS WHEN SWITCHING INTO ELEMENTARY EDUCATION SELECTED A BIOLOGY CONCENTRATION ONLY BECAUSE OF CREDITS ACCUMULATED PREVIOUSLY. THE AUTHOR CONCLUDED THAT THE BEST SOURCE OF CANDIDATES TO SELECT A CONCENTRATION WAS THAT GROUP OF STUDENTS WHO HAD A PREFERENCE FOR THE CONCENTRATION AREA AT THE TIME OF ENTRANCE. (AL)

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A CRITICAL EXAMINATION OF THE DEVELOPMENT OF SCIENCE CONCENTRATIONS IN THE TEACHER PREPARATION PROGRAM FOR THE PROSPECTIVE ELEMENTARY SCHOOL TEACHER AT THE UNIVERSITY OF TEXAS

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As we progress through the twentieth century it appears that demands upon the elementary school teacher are increasing in geometric proportions, each demand being an outgrowth of needs produced by our changing society. Currently, scholars and lay public are acutely aware of what many might describe as a retarded condition in most, if not all, curriculum areas taught within the elementary school. In an effort at a solution, there have developed, nationwide, numerous curriculum revision projects in practically all areas of the curriculum. Unique to these projects is the joint involvement of scholars and professional educators, working to improve or replace the existing curriculum with new content and processes. Such is true in the area of elementary school science.

In working toward eliminating the discrepancy between what is taught about an area and the actual structure of the area as identified by the people in these projects, new demands have been placed upon the elementary school teacher. For a teacher to operate effectively

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and efficiently with new materials, he must be knowledgeable about the area and have a grasp of the modes of operation of scholars within the field.

In an effort to assist teachers in gaining this knowledge, The University of Texas requires each undergraduate in elementary education to select one of eighteen areas as a field of subject matter concentration. In this concentration the student will complete eighteen to twenty-four semester hours of work from that department. The available concentrations are as follows: Anthropology, Biology, English, French, Geography, Geology, German, Government, History, Mathematics, Physical and Health Education, Russian, Sociology, Spanish and Speech. Three additional concentration areas of Chemistry, Italian and Physics were added at the Spring registration, 1966. It is hoped that prospective teachers will be sufficiently competent not only in teaching their areas of concentration but will be capable of providing educational leadership for a school and/or system through assisting in the identification of desirable directions and interpretation of the area to fellow teachers.

Proceeding on the premise that a great amount of the educational leadership, particularly of local nature, in elementary school science in Texas may well come from those undergraduates selecting science as an area of concentration, The Project for Team Teaching and Experimental Teacher Education at The University of Texas is currently engaged in a study of the concentration system at The University. It is hoped that this study will both illuminate the preparation of undergraduates in

Elementary Education and give direction for future programs of teacher education.

Of approximately 1200 undergraduates in elementary education, a total of 658 have declared a concentration. These are predominately students of Junior and Senior classifications. A distribution of their selections is found in Table 1.

Table 1

DISTRIBUTION OF CONCENTRATION

Concentration	Number of Students	Percent of Students
Sociology	183	27.8
English	171	26.0
History	69	10.5
Speech	61	9.3
Mathematics	54	8.2
Foreign Language	30	4.4
Geography	27	4.1
*Biology	25	3.8
Physical Education	13	2.0
Anthropology	12	1.8
Government	11	1.7
*Geology	2	0.3
	658	

As seen in Table 1 Biology and Geology account for a combined total of twenty-seven students or 4.1% of the total. While this percentage is less than most, it should be noted that it is an increase from 1.9%, which was found in February, 1965. This increase, it is felt, is due partially to limited student counseling.

If substantial improvement is to be made in professional leadership in science at the local level, then it would seem that effort should be made to increase the number of students selecting science as a concentration. While this alone will not insure adequate leadership in elementary school science, it would indicate increased interest in the area.

In counseling more students toward the area of science, it is necessary to attempt a description of the type of person who is most apt to go in this direction and to identify the population in which he can be found.

To investigate if the student selecting a science would differ scholastically from other students, comparisons were made on the basis of the School and College Aptitude Test. Scores for the SCAT were available for 608 of the students declaring concentrations, or 92.4% of the population. Mean scores for students within each area are given in Table 2. (Also see Appendix A)

An analysis of variance was computed on the means for the verbal, quantitative and total mean scores. Differences among the verbal scores and the quantitative scores were significant at the .00001 level. Differences among the total scores were significant at the

Table 2

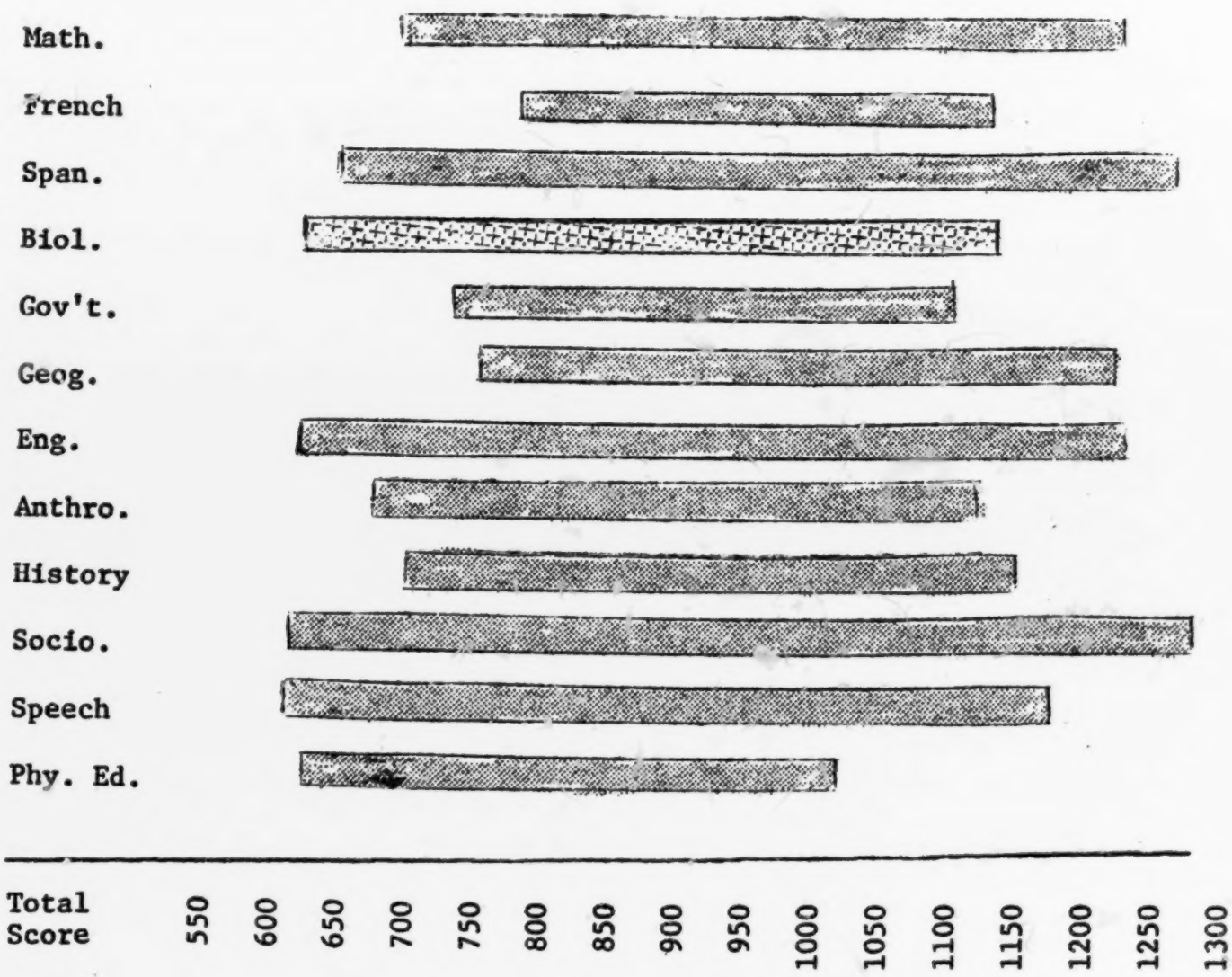
MEAN SCAT SCORES FOR STUDENTS WITHIN EACH CONCENTRATION

Verbal	Quantitative	Total
507.14 (French)	538.09 (Math)	1006.93 (Math)
506.00 (Government)	494.28 (French)	1001.42 (French)
493.34 (Spanish)	478.99 (Spanish)	972.34 (Spanish)
*490.62 (Biology)	*477.46 (Biology)	* 964.23 (Biology)
480.51 (English)	472.94 (Geography)	953.76 (Gov't.)
474.47 (History)	461.09 (Anthro.)	943.00 (Geog.)
472.84 (Geog.)	454.96 (Sociology)	929.43 (English)
468.81 (Math.)	453.81 (English)	928.72 (Anthro.)
465.58 (Socio.)	452.01 (History)	925.93 (History)
463.73 (Anthro.)	446.56 (Gov't.)	920.54 (Sociology)
445.28 (Speech)	445.46 (Phy. Ed.)	888.16 (Speech)
408.23 (Phy. Ed.)	442.89 (Speech)	853.69 (Phy. Ed.)

.01 level. However differences among adjacent scores were not found to be significantly different. Students selecting Biology scored no differently on this test than did students selecting Spanish or Government. Hence it is impossible to predict with any degree of accuracy to which concentration a student with a given SCAT score will move. This is further born out by the range of scores as found in Table 3.

Table 3

RANGE OF SCORES FOR STUDENTS IN TWELVE CONCENTRATIONS



As a final test to investigate relationships between a student's SCAT scores and the number of students selecting a given concentration, a Spearman Rank Order Correlation was computed between the number of students selecting a concentration and mean SCAT scores for subjects in the concentration. A correlation of -.03 was found. Students with lower SCAT scores, of which there are many, do not tend to select Sociology or English concentrations while students who have higher

SCAT scores, of which there are fewer, do not tend to select Mathematics, a foreign language, or a science.

In an attempt to look at other factors which might be of prime importance in aiding a student to select an area of concentration, a questionaire was distributed and collected from all elementary education majors registering for the Fall Semester, 1965. Students who had declared concentrations were asked to indicate which area they most preferred upon graduation from high school. Appendix B indicates the movement of students as they move into and from the areas of concentration. As can be seen, initially 52 students entered The University preferring Biology. Of this number 15 selected Biology as a concentration. Nine other students who entered The University preferring other areas selected Biology as a concentration. Conversation with a number of this latter group indicated that for some the selection of Biology was due to transfer into Elementary Education from a major in which a number of hours in Biology had been accrued. Three of this group indicated that had they not transferred into education with so many hours of Biology, they would have selected another area in which to concentrate.

A test for difference between means was computed for (1) SCAT scores of the fifteen students remaining in Biology, their area of preference at high school graduation, (2) SCAT scores of the students preferring Biology at high school graduation but selecting another concentration, and (3) SCAT scores of students preferring a different area at high school graduation but selecting Biology as a concentration. No significant differences were found among these three groups.

As illustrated in Table 4 and Figure 1 only 27.7% of all students preferring Biology and Geology upon high school graduation selected either as an area of concentration. Except for French, these two areas lost a greater percentage of students to other areas than any other group. The students remaining comprised 55.5% of the total number in science. When viewed in light of the fact that 62.9% of all students select the same area for concentration as preferred upon high school graduation, then it would seem that the most probable population to cultivate for students to pursue concentrations in science would be those entering The University with preferred interest in the area. From all appearances, the attitudes toward an area of concentration are developed for a large number of students prior to entrance into The University.

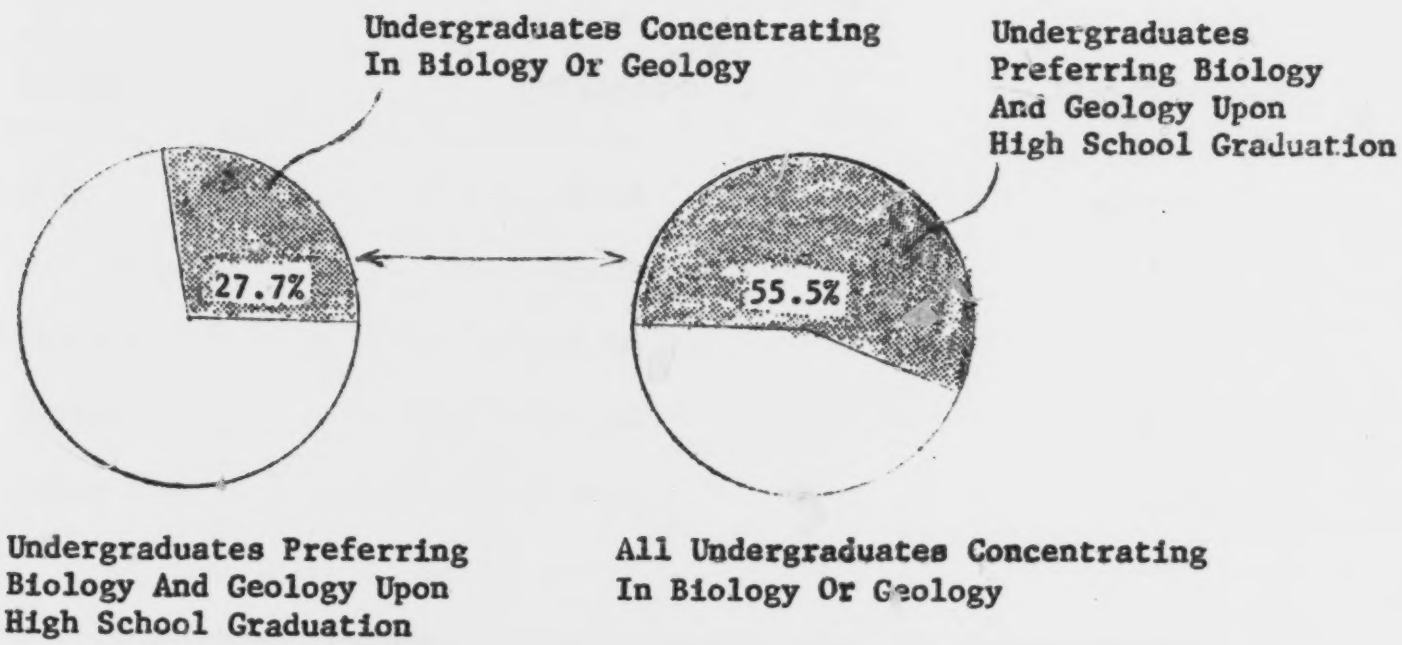
Table 4

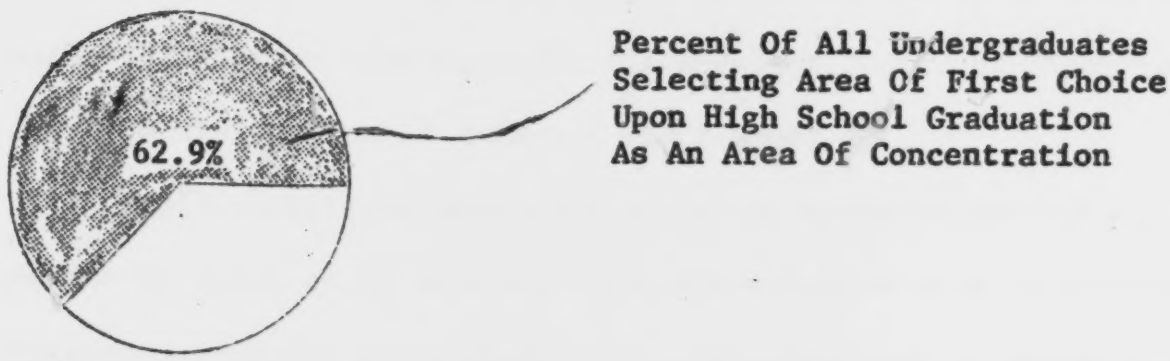
HOLDING POWER OF AREA OF PREFERENCE AT HIGH SCHOOL GRADUATION

Area of Preference	% Of Students Remaining In Area Of First Preference	% Of Total Number In Each Concentration Who Selected It As An Area of Preference At H.S. Graduation
Sociology	95.7	48.6
Speech	80.5	54.1
Anthropology	71.4	41.5
Spanish	66.7	33.3
English	63.2	82.5
History	61.5	69.7
Mathematics	56.3	74.1
Phy. Educ.	56.3	58.0
German	50.0	33.3
Geography	47.1	29.6
Government	38.1	72.7
*Biology	28.8	60.0
French	0.0	0.0
*Geology	0.0	0.0

Figure 1

HOLDING POWER OF BIOLOGY AND GEOLOGY AS COMPARED WITH ALL CONCENTRATIONS


Undergraduates Concentrating In Biology Or Geology
Undergraduates Preferring Biology And Geology Upon High School Graduation
27.7%
55.5%
Undergraduates Preferring Biology And Geology Upon High School Graduation
All Undergraduates Concentrating In Biology Or Geology


62.9%
Percent Of All Undergraduates Selecting Area Of First Choice Upon High School Graduation As An Area Of Concentration
All Undergraduates Who Have Selected A Concentration

Another question is raised as to what assistance or discouragement a student has received in making his decision to concentrate in Biology or Geology. The twenty-seven students in these two areas were asked this question. The findings are given in Table 5.

Table 5

SOURCES OF GUIDANCE OR DISCOURAGEMENT FOR STUDENTS CONCENTRATING IN BIOLOGY OR GEOLOGY

Source	Guidance	Discouragement
Self	70.0%	----
U.T. Faculty	15.0%	5.5%
Friends	11.0%	71.0%
Family	4.0%	18.0%
Other	0.0%	5.5%

From these responses it would appear that the undergraduate who is in the process of selecting a concentration in science is in daily interaction with friends, his greatest source of discouragement, while receiving minimal guidance and support.

Finally, there is need to examine the students perception of the degree of value to be received from his selected area of concentration. Sixty-nine percent of students with concentrations in science, the majority of whom had classroom teaching experience, felt that had they not been required to select a concentration it would have made little or no difference in their teaching experiences. For the total undergraduate population who had selected a concentration, 79% were of the same opinion. Two problems are raised here which may be of national concern. First, are the course requirements within each area of specialization for the prospective elementary school teacher

realistic in terms of the tasks he will perform. Second, but basic to evaluation of this or any other program, has the prospective teacher been assisted in developing an understanding of the application of the concentration to teaching.

In summary a number of general statements seem to emerge as guidelines for the counseling of undergraduates in elementary education at The University of Texas. These include:

(1) Attitudes toward areas of concentration are established for a majority of the students prior to entering The University.

(2) Students with a preference for a given concentration area at the time of entrance into the University are the best source of candidates for that area. However, a sizeable number of students do change preference after entrance into The University.

(3) If more undergraduates in elementary education are to select concentrations in science, then not only must a larger percentage of those students entering The University preferring science be kept, but the total number must be increased.

(4) While concentrations in science tend to attract students of higher ability as measured by the School and College Aptitude Test, students of lower ability can also complete the concentration successfully.

(5) Responsibility for the selection of a concentration is generally placed with the student. While he feels that he

receives very little guidance, he receives considerable discouragement from peers in selecting an area of science. Pilot efforts at counseling have indicated that students are receptive to professional guidance. While counseling may not alter the distribution considerably, we have no indication as to the degree of change which might take place.

(6) Students concentrating in science tend toward the Biological sciences. It should be noted that this is inconsistent with the selection of other undergraduates in elementary education who only have six hours of science in their programs. This group comprises 80.67% of the total number majoring in elementary education. For these students 47.44% have selected Geology, while 33.92% have selected Biology and 17.79% have selected Chemistry. It would appear that undergraduates are more apt as teachers to place emphasis on the earth sciences. However, in a survey of students who were enrolled in student teaching, 67% reported that the science topic they would most like to teach was one in which they had received no related instruction at the university level. Hence, it would appear difficult to predict which areas of the curriculum will receive major emphasis as based upon undergraduate course work.

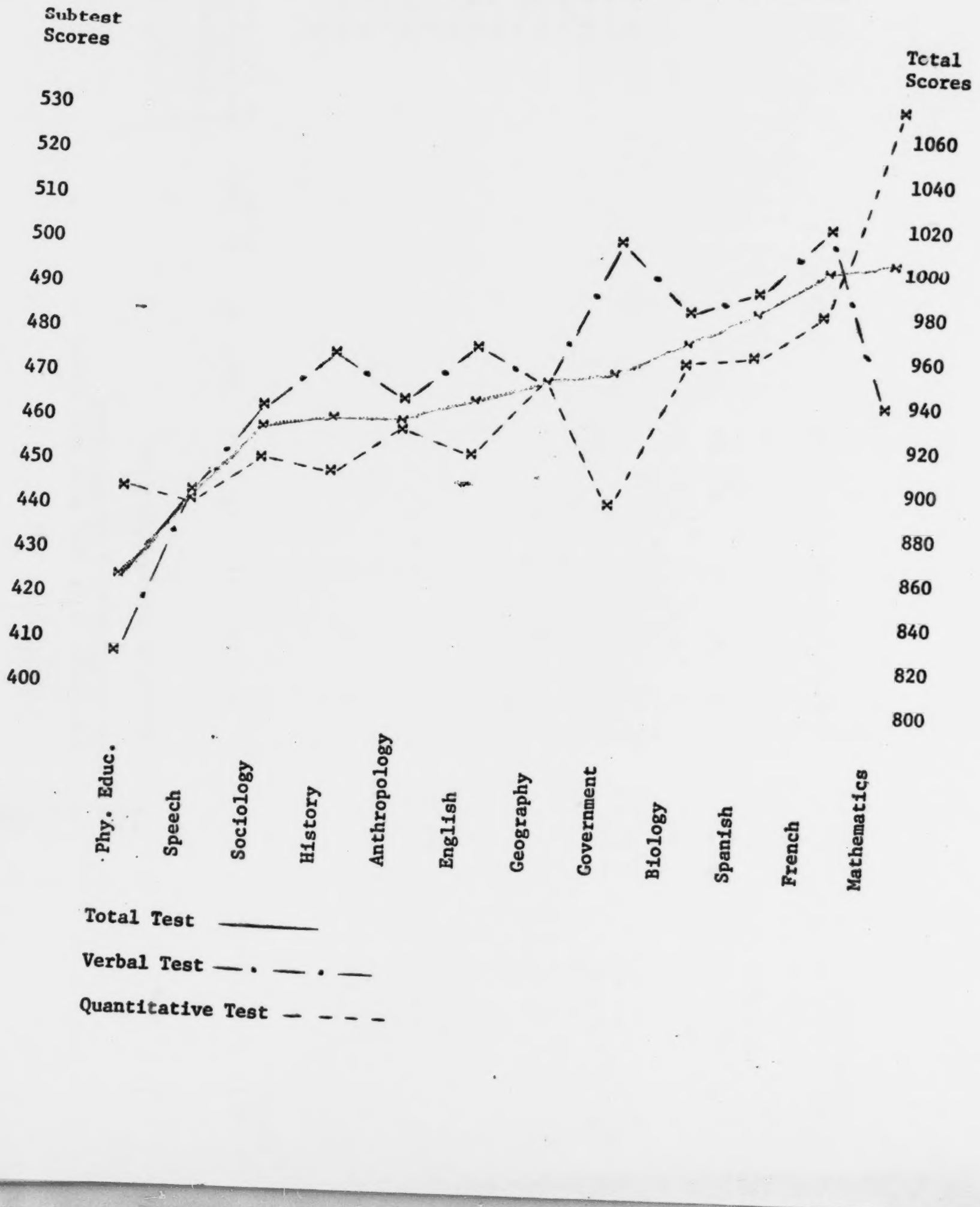
(7) Finally, both observation of teacher behavior and a survey of prospective teacher attitudes indicate a lack of insight into the application of a concentration to the teaching act.

If teachers are to perceive the relationship between content and instruction it would appear that effort will have to be made to assist the undergraduate in building the connection. At The University of Texas such an attempt is currently being made through a pilot program under the direction of The Project for Team Teaching and Experimental Teacher Education.

While this examination has focused upon the program of undergraduate concentrations for elementary education majors at The University of Texas, and in particular upon concentrations in Biology and Geology, it is doubtful that the situation is unique only to that institution. This study is presented with the hope that it will assist others concerned with similar problems in teacher education.

APPENDIX A

MEAN SCORES ON SCAT TEST FOR STUDENTS IN TWELVE CONCENTRATIONS



APPENDIX B

COMPARISON OF STUDENT PREFERENCE OF AN AREA UPON HIGH SCHOOL GRADUATION WITH HIS SELECTION OF A CONCENTRATION

First Choice Upon High School Graduation

Concentration	No. in Major	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	No 1st. Choice	% In Concentration Who Preferred Area At H.S. Graduation
1. Anthropology	12	5	2	3						2								41.7
2. Biology	25		15	4		2				1	1					1	1	60.0
3. English	171		9	141	3		1			3	6	2		2	2	2		82.5
4. French	2				—				1						1			0.0
5. Geography	27		3	7		8			2	2	2	1		2				29.6
6. Geology	2			1			—								1			0.0
7. German	3			1				1		1								33.3
8. Government	11			1					8	2								72.7
9. History	69	1	4	7					3	48	4					2		69.7
10. Mathematics	54			8	3	1	1		1		40							74.1
11. Phy. Educ.	13									2	2	9						58.0
12. Russian	1											1	—					0.0
13. Sociology	183		14	36	3	4			5	14	10	1		89	3	3	1	48.6
14. Spanish	24	1	3	4											16			33.3
15. Speech	61		2	9	1	2		1	1	3	6	2			1	33		54.1
No. Indicating Area As 1st. Preference At H.S. Graduation		7	52	223	10	17	2	2	21	78	71	16	0	93	24	41	2	
% Currently In Area of 1st. Choice At H.S. Graduation		71.4	28.8	63.2	0.0	47.1	0.0	50.0	38.1	61.5	56.3	56.3	0.0	95.7	66.7	80.5		